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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/782,657	02/19/2004	Michael K. Gallagher	50824-5C	5492

53884 7590 04/04/2007

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EXAMINER	
SULLIVAN, CALEEN O	
ART UNIT	PAPER NUMBER
1756	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/04/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/782,657	GALLAGHER ET AL.	
	Examiner	Art Unit	
	Caleen O. Sullivan	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 February 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *15-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *02/19/04; 08/25/04; 11/22/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

The information disclosure statement filed 08/25/2004 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 15-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carter ('263) in view of Allen ('441) and further in view of Huang ('073).

Carter ('263) teaches a process of forming an integrated circuit using a dielectric material that comprises porous organic polysilica. First, Carter ('263) discloses that a dielectric material

comprising organic polysilica and decomposable polymer is disposed on a substrate. (See, col.4, 15-18). The second step of the process involves heating the composition, in the presence of a base that lowers initial cure temperatures, to cross condense the polysilicon silyl reactive groups. (See, col.4, 22-30). The next step of the process is the lithographic patterning of the dielectric layer to form trenches. (See, col.40-58). This disclosure meets the limitations of claims 15 and 22 where the dielectric material is disposed on a substrate, cured and then patterned.

Then Carter ('263) discloses that a metallic film is deposited on the dielectric layer, which preferably includes copper as recited in claim 23, tungsten, or aluminum. This disclosure meets the limitation of claims 15 and 22 where a metal layer is deposited on the dielectric material. Figure 4, demonstrates that the metal layer is an aperture filling layer, which meets the limitation of claim 18.

Carter ('263) goes on to disclose that a planarizing step occurs in order to remove excess metallic material, as recited in claim 20 and 22, so the features are level with dielectric layer. (See, col.5, 1-5). Carter ('263) then discloses the last step of the process, which is a step of decomposing the decomposable polymer dispersed in the polysilica matrix to form the porous polysilica. (See, col.4, 37-39). Carter ('263) defines decomposition of the dielectric layer as when the decomposable polymer decomposes to volatile fragments, which diffuse out the rigid polysilica matrix leaving voids behind. (See, col.3, 55-57). This disclosure meets the limitations of claims 15 and 22, where porogen is removed from the porous dielectric layer without substantially degrading the dielectric material.

Carter ('263) also discloses that suitable organic polysilica includes silesquioxane such as alkyl; aryl; or alkyl/aryl silesquioxanes as recited in claim 17 and that suitable decomposable polymers includes polyethers such as poly (propylene oxide), which meets the limitation of claim 16.

Although, Carter ('263) does not explicitly disclose that the removable porogen is substantially compatible with the dielectric material, it is inherent that the porogen is compatible

with the dielectric material if after decomposition the material has enhanced properties such as mechanical toughness, crack resistance, and dielectric properties. (See, col.3, 65-67).

However, Carter ('263) fails to disclose the limitation of claim 22 where a barrier or seed layer and then an aperture fill metal layer is deposited on the dielectric material layer, and the limitation of claims 15 and 22, where the dielectric matrix material is decomposed by exposure to heat and radiation. Moreover Carter ('263) fails to disclose the limitation of claims 21 and 24, where the radiation source is chosen from visible light, IR, microwave, UV and electron beam.

Allen ('441) discloses a step of decomposing a porous dielectric material, to be used in the manufacture of electronic devices, by exposure to heat and radiation where the radiation source includes visible light, IR, microwave, UV and electron beam. Allen ('441) discloses porous dielectric materials that have low dielectric constants and are useful in manufacturing electronic devices. Allen ('441) discloses that in order for the porogens forming the porous dielectric to be useful they must be at least partially removable under conditions that do not adversely affect the dielectric matrix material. (See, col.10, 10-15). Allen discloses that typical methods of removal includes exposure to heat, pressure or radiation including actinic, IR, x-ray, gamma, microwave, with a preference for exposure to heat or UV light to remove the porogen. Moreover, Allen ('441) discloses that a combination of heat and radiation can also be used to remove the porogens from the dielectric matrix material. (See, col. 10, 54-59).

Still Carter ('263) in view of Allen ('441) fails to disclose the limitations of claim 22 where a barrier or seed layer and then an aperture fill metal layer are deposited on a dielectric layer. However, Huang ('073) discloses such a process step. Huang ('073) discloses a method of patterning a dielectric layer for a damascene process. After patterning the dielectric layer to form a trench, a damascene process is completed to form a metal line. This metal line is formed by first depositing a

glue/barrier layer which is conformal to the trench. Then a metal layer such as copper, aluminum or a copper-aluminum alloy is formed on the glue/barrier layer, which fills the trench (See, col.3, 7-49). This is followed by a CMP step to remove undesired metal. (See, col.3, 50-51). This disclosure meets the limitations of claim 22 where a barrier or seed layer and then an aperture fill metal layer, which is comprised of copper or copper alloy as recited in claim 23, is deposited on a dielectric layer.

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the teachings of Carter ('263) because Allen ('441) teaches that one can decompose a porous dielectric matrix material layer by using heat and radiation including UV, IR, and microwave, and Huang ('073) teaches that one can deposit a seed layer and an aperture fill metal layer that comprises copper or copper alloy on a dielectric layer.

Double Patenting

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 15-24 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-7 and 9 of U.S. Patent No. 6596467 in view of Allen ('441). US Patent No. 6596467 claims methods of manufacturing electronic devices using a low dielectric

constant material that is prepared by using a removable porogen material. The method of claims 1-7and 9 fail to claim the limitations of claims 15 and 22 in the present application where the dielectric material matrix material is subjected to heat and radiation to at least partially remove the porogen to form a porous dielectric material layer without substantially degrading the dielectric material. Moreover, the methods of claims 1-7 and 9 fail to claim the limitation of claims 21 and 24 in the present application where the radiation is chosen from visible light, IR, microwave, UV and electron beam.

However, Allen ('441) discloses such a process step. Allen ('441) discloses porous dielectric materials that have low dielectric constants and are useful in manufacturing electronic devices. Allen ('441) discloses that in order for the porogens forming the porous dielectric to be useful they must be at least partially removable under conditions that do not adversely affect the dielectric matrix material. (See, col.10, 10-15). Allen discloses that typical methods of removal includes exposure to heat, pressure or radiation including actinic, IR, x-ray, gamma, microwave, with a preference for exposure to heat or UV light to remove the porogen. Moreover, Allen ('441) discloses that a combination of heat and radiation can also be used to remove the porogens from the dielectric matrix material. (See, col. 10, 54-59).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the claims of US Patent No. 6596467 with the teachings of Allen ('441) because Allen ('441) teaches that one can decompose a porous dielectric matrix material layer by using heat and radiation including UV, IR and microwave.

6. Claims 15-17 and 19 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 7-8, 10, 20-21, 27-28, 32 and 34 of U.S. Patent No. 7163780 in view of Allen ('441). Claims 1, 7-8, 10, 20-21, 27-28, 32 and 34 recite a method of

forming a porous dielectric material layer in an electronic device. However, claims 1, 7-8, 10, 20-21, 27-28, 32 and 34 of US Patent No. 7163780 fail to recite that the dielectric matrix material is subjected to heat and radiation to at least partially remove the porogen to form a porous dielectric material layer without substantially degrading the dielectric material. Moreover, claims 1, 7-8, 10, 20-21, 27-28, 32 and 34 fail to recite that the radiation is chosen from visible light, IR, microwave, UV and electron beam.

However, Allen ('441) discloses such a process step. Allen ('441) discloses porous dielectric materials that have low dielectric constants and are useful in manufacturing electronic devices. Allen ('441) discloses that in order for the porogens forming the porous dielectric to be useful they must be at least partially removable under conditions that do not adversely affect the dielectric matrix material. (See, col.10, 10-15). Allen ('441) discloses that typical methods of removal includes exposure to heat, pressure or radiation including actinic, IR, x-ray, gamma, microwave, with a preference for exposure to heat or UV light to remove the porogen. Moreover, Allen ('441) discloses that a combination of heat and radiation can also be used to remove the porogens from the dielectric matrix material. (See, col. 10, 54-59).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the claims of US Patent No. 7163780 with the teachings of Allen ('441) because Allen ('441) teaches that one can decompose a porous dielectric matrix material layer by using heat and radiation including UV, IR and microwave.

7. Claims 22-24 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 7-8, 10, 20-21, 27-28, 32 and 34 of U.S. Patent No. 7163780 in view of Allen ('441) and further in view of Huang ('073). Claims 1, 7-8, 10, 20-21, 27-28, 32 and 34 recite a method of forming a porous dielectric material layer in an electronic device. However,

claims 1, 7-8, 10, 20-21, 27-28, 32 and 34 of US Patent No. 7163780 fail to recite that the dielectric matrix material is subjected to heat and radiation to at least partially remove the porogen to form a porous dielectric material layer without substantially degrading the dielectric material. Moreover, claims 1, 7-8, 10, 20-21, 27-28, 32 and 34 fail to recite that the radiation is chosen from visible light, IR, microwave, UV and electron beam.

However, Allen ('441) discloses such a process step. Allen ('441) discloses porous dielectric materials that have low dielectric constants and are useful in manufacturing electronic devices. Allen ('441) discloses that in order for the porogens forming the porous dielectric to be useful they must be at least partially removable under conditions that do not adversely affect the dielectric matrix material. (See, col.10, 10-15). Allen discloses that typical methods of removal includes exposure to heat, pressure or radiation including actinic, IR, x-ray, gamma, microwave, with a preference for exposure to heat or UV light to remove the porogen. Moreover, Allen ('441) discloses that a combination of heat and radiation can also be used to remove the porogens from the dielectric matrix material. (See, col. 10, 54-59).

Still, claims 1, 7-8, 10, 20-21, 27-28, 32 in view of Allen ('441) fails to recite that a barrier layer and then an aperture fill metal layer of copper are deposited on the surface of the dielectric material. However, Huang ('073) teaches such process steps.

Huang ('073) discloses a method of patterning a dielectric layer for a damascene process. After patterning the dielectric layer to form a trench, a damascene process is completed to form a metal line. This metal line is formed by first depositing a glue/barrier layer which is conformal to the trench. Then a metal layer such as copper, aluminum or a copper-aluminum alloy is formed on the glue/barrier layer, which fills the trench (See, col.3, 7-49). This is followed by a CMP step to remove undesired metal. (See, col.3, 50-51). This disclosure meets the limitations of claim 22 where a barrier

or seed layer and then an aperture fill metal layer, which is comprised of copper or copper alloy as recited in claim 23, is deposited on a dielectric layer.

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the claims of US Patent No. 7167380, because Allen ('441) teaches that one can decompose a porous dielectric matrix material layer by using heat and radiation including UV, IR, and microwave, and Huang ('073) teaches that one can deposit a seed layer and an aperture fill metal layer that comprises copper or copper alloy on a dielectric layer.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caleen O. Sullivan whose telephone number is 571-272-6569. The examiner can normally be reached on 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

COS, 3/26/2007

MARK F. HUFF
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